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GEOGRAPHIC VARIATION IN THE NEW WORLD
GECKKONID LIZARD *TARENTOLA*
AMERICANA GRAY

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Tarentola americana Gray is the sole New World member of the otherwise Old World genus *Tarentola*. Although the first name proposed for the New World species is *T.* (as *Platydyctylus*) *americana* Gray (1831), this name was based upon a specimen supposedly taken in New York, and *americana* was long considered a distinct species which had not been subsequently collected. Later, Duméril and Bibron (1836) redescribed (using the same specimen as the holotype) *T. americana*, naming the species *Platydyctylus milbertii*. Finally, Gundlach and Peters (1835) described *Platydyctylus americanus* var. *cubanus* from Cuba. The Antillean *Tarentola* was consistently called *T. cubana* (Barbour, 1914; Barbour, 1916; Barbour and Ramsden, 1919; Alayo, 1951), but Love-ridge (1944) relegated this name to the synonymy of *T. americana*, since he considered that all three names (*americana*, *milbertii*, *cubana*) referred to the same species. Later authors (Alayo, 1955; Schwartz and Ogren, 1956; Ruibal, 1957; Buide, 1966, 1967) have consistently used *T. americana* for these geckos.

T. americana was long considered a rare (or local) inhabitant of Cuba. Barbour (1914: 259) commented that the species was seldom found; at that time the Museum of Comparative Zoology at Harvard University had material only from Santiago de Cuba, and Barbour had seen a single specimen from Cienfuegos. Barbour also reported that Gundlach had found only two specimens in his entire life in Cuba, one

from San Diego de los Baños in the Sierra del Rosario in Pinar del Río Province and the other from Cabo Cruz in Oriente Province. Barbour and Ramsden (1919: 116–117) stated that *Tarentola* was “generally a very rare lizard,” although they stated that there were particular localities where the species was easily obtained (such as at Puerto Escondido near the Bahía de Guantánamo in Oriente Province). They stated that the species was extremely rare outside of a few stations in Oriente, but that it had been collected in the westernmost Cuban province, Pinar del Río; thus the lizard was shown to have an islandwide distribution. Ruibal (1957: 257) secured *T. americana* abundantly on the cays of the Laberinto de los Doce Leguas off the south coast of Camagüey Province; later, Buide (1966: 4) noted that he had collected, in only three visits to the locality, about 60 specimens from Cueva Ambrosio on the Península de Hicacos on the north coast of Matanzas Province. Far from being rare outside of Oriente, *T. americana* can be secured in some numbers, provided its habitat requirements are known.

Barbour (1916: 219–220) was the first to report *Tarentola* (as *T. cubana*) from the Bahama Islands; he had a single specimen, collected by C. J. Maynard, from U Cay, of the Allan’s Harbour Cays near Highborn Cay, in the northern portion of the chain of Exuma Cays. Later, Barbour (1930: 82) reported the lizard from Andros Island in the Bahamas. Although Rabb and Hayden (1957: 23) collected fourteen specimens of *T. americana*, all were from Leaf Cay of the Allan’s Harbour Cays, so that the known distribution of the species in the Bahamas was not considerably extended by their fine series. Although *T. americana* is presently fairly well represented in American collections from most Cuban provinces (with the exceptions of Habana and Matanzas provinces), there has been an extreme paucity of specimens of this lizard from its Bahaman range, with the material reported by Rabb and Hayden being the only Bahaman series available. Although *T. americana* had only been reported from two regions (Andros; Exuma Cays) it was expected that its range would ultimately be shown to include many (if not all) of the islands on the Great Bahama Bank, at least. Pre-

vious lack of sufficient Bahaman material has prevented comparison of Cuban and Bahaman specimens; fortunately there are now available a total of 44 Bahaman specimens so that variation in *T. americana* can now be clarified.

Almost half of the Cuban *T. americana* examined are the result of collections made in Cuba by myself and parties between the years 1956 to 1960; these specimens are in the collection of the American Museum of Natural History (AMNH). I have also borrowed material in the collections of the Carnegie Museum (CM), Museum of Comparative Zoology (MCZ), University of Florida, Florida State Museum (UF/FSM), and the Museum of Zoology, University of Michigan (UMMZ). For the loans of these lizards I wish to thank Charles M. Bogert and George W. Foley, Neil D. Richmond and Clarence J. McCoy, Jr., Walter Auffenberg, and Charles F. Walker and Arnold G. Kluge. The large number of Bahaman individuals now in collections are in part due to the activities of Wayne King, Neil D. Richmond, Richard Thomas, and C. Rhea Warren; material collected by Messrs. Thomas and Warren are in the Albert Schwartz Field Series (ASFS), whereas that collected by Dr. King is in the UF/FSM collection; the series collected by Dr. Rabb and Mr. Hayden has already been mentioned. My Cuban collections were made under National Science Foundation Grants G-3865 and G-6252; during my Cuban field work I had the assistance of John R. Feick, William H. Gehrman, Jr., Ronald F. Klinikowski, David C. Leber, James D. Smallwood, Barton L. Smith, Richard Thomas, and George R. Zug, to all of whom I am grateful for their cooperation.

I have taken the following counts and measurements on all adult and subadult *T. americana*. A total of 130 specimens is available from Cuba, the Bahamas, and the Isla de Pinos; the species has not been previously reported from the latter island, although it was expected there.

1) *Sex*. The external sexual characteristics of *T. americana* are rather subtle, but once they are understood, all specimens, regardless of age, can be sexed without difficulty. Just posterolaterally to the vent, there is in males a pair of semilunar series of enlarged (in respect to the scales both anteriorly and posteriorly to them) scales, usually three in number,

which project boldly from the lateral and ventral margins of the tail and are on a rounded prominence. In females, these scales are not so enlarged nor so conspicuous nor on an enlarged prominence. In males, the scales are usually dead white and contrast sharply with the buffy or brownish color of the tail, whereas in females the scales are often concolor with the remainder of the tail surface in that area. Although these color differences are not absolute, the bold and tooth-like appearance of the semilunar scales in males is a striking feature of that sex. Verification of these sexual differences was made by extrusion of hemipenes in males and visible shelled eggs in females. Sex of even very small *T. americana* can be determined with a high degree of accuracy, if the student is aware of the changes in size of these semilunar scales in respect to the size of the animal.

The hemipenis of *T. americana* has not been previously described. As extruded (ASFS V11232), the organ is relatively short, extending for about the length of seven or eight ventral caudal scales, and is rather strongly bifurcate for its distal third. The basal half is smooth; the distal half is minutely calyculate on both the sulcate and non-sulcate surface. The sulcus spermaticus divides at that point where the hemipenis becomes bifurcate, each branch extending thence onto the terminal surface of the weakly crenulate apices; each of these branches forks once more, on the apex, or, perhaps more properly, on each apex are two weak grooves which radiate from the termination of the fork of the sulcus spermaticus. The hemipenis is quite simple in total aspect, although as extruded it is rather robust.

2) *Snout-vent length*, in millimeters.

3) *Longitudinal rows of enlarged dorsal scales at midbody*. Although this count has been employed by other students of the genus *Tarentola* (Loveridge, 1944; Grandison, 1961), the situation in *T. americana* is such that a perfectly accurate count of these scales is not possible. The dorsal scales, in adults, are keeled and prominently set off from the much smaller interstitial paving scales; as these enlarged scales progress down the sides, and especially at the extreme ventrolateral area, they become smaller and stud-like, less obvious, and more like the ventrals in size. Although the ventrolateral "dorsals" are quite different from the smooth and imbricate ventrals, ventrolaterally the former become more like both the interstitial scales and the ventrals. In one population, there are additionally about four to eight rows of transitional scales scattered between the ventrolateral "dorsals" and the ventrals, so that the arrangement of scales in this whole ventrolateral area, with its conglomeration of differently sized scales, all of which intergrade with one another in size, makes an accurate count of enlarged dorsal rows difficult indeed. Loveridge (1944: 19) gave the range of dorsal tubercles as 13 to 17 in 15 Cuban and two Bahaman specimens, whereas in a much larger series, my counts vary between 12 (MCZ 11877, a specimen examined by Loveridge) and 24 (ASFS V11232, a Bahaman specimen not available to Loveridge). Although there are mean and modal differences in

dorsal counts as I made them, I strongly doubt that any two investigators would count the same number of longitudinal rows of dorsal scales on many specimens.

4) *Number of ventral scales*, counted transversely at midbody. The ventral scales of *T. americana* are smooth, rounded, and imbricate. The transition from the ventrolateral enlarged studs and interstitial scales to the smooth ventrals is fairly abrupt, but, if a count is made from what appears to be the area of transition on one side to that of the other, a great source of error is encountered; one is simply not sure which of the transitional scales should be considered ventrals and which slightly enlarged and smoother interstitials. Fortunately, a more finite boundary for ventrals occurs in *T. americana*. Laterally, the belly is set off from the sides by a pair of longitudinal folds, one on each side, similar in aspect to the belly disc in some frogs. When preserved, the lateral limits of the venter are strongly shown by these lateral folds; even in specimens which were injected upon preservation, the folds are discernible and make excellent landmarks for beginning and ending the ventral counts. Since these counts are easily made and the limits on each side quickly and accurately determined, they are far more reliable, and I have placed much more emphasis upon them than on the dorsal counts.

5) *Interorbital scales*. This count includes the superciliary scales on each side.

6) *Gulars*. Grandison (1961: 3) counted the number of transverse gulars between the ears. I have counted the longitudinal number of gulars contained within the distance between the posterior border of the orbit and the anterior border of the auricular opening, this distance set off by vernier calipers on the center of the throat at the level of the ears. The gulars in *T. americana* are small, smooth, rounded, and closely juxtaposed. This count was not taken on many very small lizards. As in any situation where a particular distance (eye-ear, in this case) is laid out on another body part, there is a possibility that heterogonic growth of the head in reference to the gulars might create artificial differences between adult and juvenile lizards. This is not the case in *T. americana*; likewise, there are no sexual differences in this count. The differences in number of gulars are so striking that it would be difficult indeed to obscure them.

7) *Number of lamellae on first and fourth toes*. These data were taken on most specimens, but the variation within any series is fairly broad and the count appears meaningless as far as populations of *T. americana* are concerned.

8) *Scales between the first sublabials*, in contact with the mental. In effect, this is a postmental count, since only those scales (gulars) in contact with the mental and the first pair of sublabials were counted. The count varies from 0 (sublabials in contact behind mental) to 4 (four scales in contact with the mental and enclosed between the first sublabials).

These counts have been variously useful in defining the subspecies of *T. americana*. The differences in scutellation between the Cuban and Bahaman populations of this lizard are so striking that, for instance, comparison of lizards of comparable snout-vent lengths easily demonstrates the difference in size of ventrals, a fact verified by the counts themselves. The color and pattern differences between the two basic populations are, for the most part, less easy to explain but are nonetheless real.

Systematic Accounts

Tarentola americana Gray, 1831

Platydactylus americanus Gray, in Griffith, Animal Kingdom, 9:48 (type locality—"New York").

Platydactylus Milbertii Duméril and Bibron, 1836, *Erpét. Gén.*, 3:325 (type locality—"New York").

Platydactylus (Tarentola) americanus var. *cubanus* Gundlach and Peters, 1865, *Monatsb. Akad. Wiss. Berlin*: 384 (type locality—Cuba; here restricted to Cabo Cruz, Oriente Province, Cuba, one of two localities whence Gundlach and Peters had material at the time of the proposal of the name *cubanus*).

Type-locality: "New York"; considering the period (1831) when the holotype of *P. americanus* was collected, that the holotype was in the Paris Museum at that time and was still there at the time that Duméril and Bibron (1836) renamed the same individual *P. Milbertii*, and that it was sent to the Paris Museum by a M. Milbert, it seems likely that the specimen originated in one of the Cuban ports, and possibly even that port with which there was considerable French trade at that time; note that Duméril and Bibron stated that "Cette espèce nous a été envoyée de New-Yorck par M. Milbert," *not* that the specimen was collected in that city (although it may have been). Although both La Habana and Santiago de Cuba were prominent ports of that period, it seems more likely that the lizard originated in the vicinity of Santiago de Cuba. *Tarentola* is common in that region (Alayo, 1951), and trade between Santiago de Cuba and the previously French city of Port-au-Prince in Haiti was flourishing, due in part to presence of French coffee plantations, begun by exiles from Saint-Domingue during the revolution on Hispaniola (1791), in the Sierra de la Gran Piedra and other uplands in the vicinity of Santiago de Cuba. Marrero (1951: 608) stated that the slave rebellion in Saint-Domingue "was a notable factor in the growth and progress of Santiago. In 1808 the city had more than 20,000 inhabitants and new zones of cultivation, principally of coffee and cacao, had been developed in the mountainous areas of the Sierra Maestra, with Santiago as the commercial center. The French influence on the culture and customs of Santiago was notable." It seems very likely that the original specimen of *T. americana* was collected in the Santiago de Cuba region and was sent to Paris via New York. I therefore hereby

restrict the type locality of *Tarentola americana* Gray to the vicinity of Santiago de Cuba, Oriente Province, Cuba.

Tarentola americana americana Gray

Type-locality (by restriction): Vicinity of Santiago de Cuba, Oriente Province, Cuba.

Distribution: Throughout the island of Cuba (known in the literature from all provinces) and the Isla de Pinos (see, however, further discussion of the status of the Isla de Pinos specimens), and the Laberinto de las Doce Leguas (and probably many other off-shore islands and cays). See Fig. 1.

Definition: A subspecies of *T. americana* characterized by large size (males to 111 mm, females to 100 mm snout-vent length on Cuba, larger on the Isla de Pinos), high number of transverse ventral scales (usually 30 to 47), high number of interorbital scales, high number of gular scales, scales bordering the mental posteriorly usually 1; ventrolateral area between enlarged lateral scales and ventrals covered with from four to eight vertical rows of small interstitial scales which differ sharply from the enlarged laterals and grade into the ventrals; dorsal colors primarily shades of tan to brown, not gray to black, and pale bands on unregenerated tails vaguely streaked with darker (brown).

Remarks: The series of 80 Cuban (in contradistinction to Isla de Pinos) *T. a. americana* has the following measurements and counts: largest male (AMNH 76545—Pinar del Río) 111 mm snout-vent length, largest female (MCZ 59319—Las Villas) 100 mm snout-vent length; enlarged dorsal rows 12–22 (mean 17.4, mode 17), ventrals 27–47 (mean 33.5), interorbitals 10–17 (14.3), gulars 17–31 (24.6), first toe lamellae 10–17 (13.8), fourth toe lamellae 9–17 (14.5); scales between sublabials modally 1 (40 specimens), but other counts include 0 (11), 2 (20), 3 (7), and 4 (1).

Very few Cuban *T. a. americana* have snout-vent lengths greater than 100 mm; only 11 males have snout-vent lengths in excess of that dimension, and only one female reaches that size (although three other females have snout-vent lengths between 90 and 100 mm). There is thus some sexual dimorphism in overall size, but it is not striking. Although the total range of ventral scales is 27 to 47, only 6 of 72 Cuban specimens have counts below 30, and the mean (33.5 ± 1.01) is high.

Although there is rather limited material from throughout Cuba, there does not seem to be any west-east trend in number of ventral scales (or in numbers of other scales on which I have taken data; I emphasize ventrals because they are numerous and the count is easily and accurately taken). The Oriente sample includes both extremes (27 and 47), the low extreme from a specimen on the southern Oriente coast east of the Bahía de Guantánamo (AMNH 17727) and the high extreme from a specimen on the same coast between the Bahía de Santiago and the Bahía de Guantánamo (AMNH 95981). The modal number of ventrals in Oriente is 37, whereas that in Las Villas is 30 or 33 (both with equal

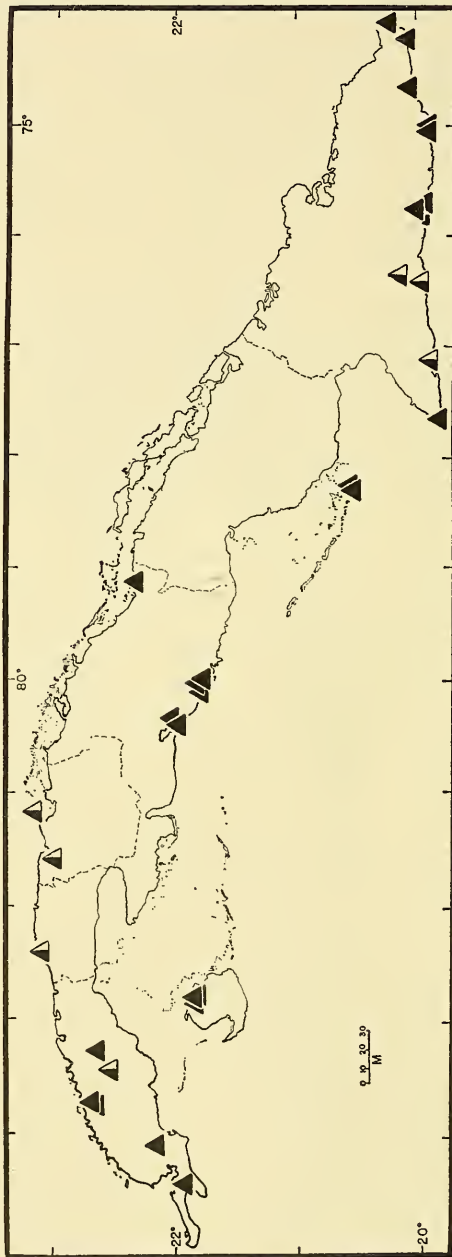


FIG. 1. Map of Cuba and the Isla de Pinos, showing (solid triangles) localities whence specimens of *Tarentola americana* have been examined. Semi-solid triangles represent localities whence the species has been recorded, if unrepresented by specimens examined (Allen and Neill, 1957; Barbour and Ramsden, 1919; Buide, 1966; Cochran, 1934; Gundlach and Peters, 1865; Stejneger, 1917).

incidences); this might indicate that there is a trend toward higher number of ventrals in the east. The Pinar del Río material, limited as it is (six specimens), includes specimens with high counts of 39, 43, and 47 (AMNH 81207), so the east-west cline seems to be reversed in the extreme western portion of the island.

The number of scales between the sublabials and bordering the mental posteriorly is modally 1 in all samples; both the Las Villas and Oriente samples have equal incidences (57.1 per cent) of this character. However, the material from the Laberinto de las Doce Leguas is bimodal, with 0 scales in this position having an equal incidence as 1 scale (6 specimens in each category of 16 total specimens). The Doce Leguas specimens likewise include the only lizard with 4 scales in this position of all *Tarentola* examined.

Description of the pattern of *T. a. americana* is made difficult by the extreme changes and obfuscation of pattern with ontogeny. In essence, the pattern consists of the following elements. The dorsal ground color is tan, with a series of four or five dark brown transverse bands across the back between the limbs, at times with some pale tan stippling along the margins of the bands. There is an additional dark brown band across the neck and there may be a second band across the neck behind the occiput. The head is tan and in younger individuals has a dark brown figure, made up of fine lines, which resembles an arrow-head, with its apex between the eyes and its open ends on the occiput. Anterior to the apex of the arrow-head may be a single median line which proceeds toward the snout and, if fully developed, forks toward the lores on each side. There is a dark brown postocular stripe, margined above by tan to buffy, which proceeds posteriorly over the shoulder and forms the lateral margins of the one (or two) nuchal bands as well as (usually) the first body band above the forelimbs. The unregenerated tail is banded with about eight or nine dark brown bands, which alternate with pale tan bands; the latter are regularly smeared with longitudinal dark brown markings, which at times are almost striae. The limbs are irregularly marbled or flecked with tan and brown; the underside is ochraceous tan in adults.

The above color and pattern notes summarize the most brightly patterned condition in *T. a. americana*. Many individuals have the dorsal bands much obscured or virtually absent, with a resultant only vaguely crossbanded lizard. The head markings may include the figure described above as well as a more posterior dark line from between the bases of the cephalic arrow-head onto the neck; in other lizards the head pattern is grossly fragmented or obscured or absent. Lizards lacking the head pattern are most often large adults, but other large adults still have the head pattern present and prominent. The postocular dark line is a regular feature at all ages; some specimens have an additional paramedian pair of dark nuchal stripes, derived from portions of the nuchal blotch, of equal width and intensity as the postocular stripes. Variation in pattern details is legion, but the basic colors are always tans and

browns (rather than grays and black), and at least some of the pattern elements described above are present on most individuals.

Special comment remains to be made on the scutellation of the lower sides. As noted previously, the enlarged dorsals decrease in size as one progresses ventrolaterally, so that on the lower sides they are smaller than on the back but still somewhat enlarged (compared to the interstitial scales) and stud-like. In *T. a. americana*, between these lowermost enlarged "dorsals" and the fold which laterally delimits the venter and its smaller, smooth, and rounded scales, there is an area of small flattened scales. These scales are arranged in from four to eight vertical rows (depending upon the ventral extent of the enlarged scales above them), and these small scales grade gradually into the ventral scales, so that the scales on the ventrolateral folds are typical of those of the venter, not of the transitional scales. As will be seen later, the Bahaman populations lack this feature of scutellation.

The six lizards from the Isla de Pinos are three adult and one juvenile males and two adult females. These lizards differ in several ways from their Cuban relatives. First, the largest specimens of all *T. americana* are in this Isla de Pinos series, despite much greater numbers of specimens from both Cuba and the Bahama Islands. The largest Isla de Pinos male has a snout-vent length of 120 mm, and the two other adult males have snout-vent lengths of 119 and 100 mm. The largest female *T. americana* is an Isla de Pinos individual with a snout-vent length of 111 mm, and the other female from that island has a snout-vent length of 105 mm. Although the differences in snout-vent lengths between this short Isla de Pinos series and the Cuban material are not exceptionally great, it may be more than coincidence that the largest *Tarentola* are from the Isla de Pinos. Secondly, the adults of both sexes from the Isla de Pinos are virtually patternless, having only the vaguest indication of crossbars or none at all. Two adult individuals with complete or nearly complete tails show no tail banding, the tails being concolor with the dorsum. Even the regularly consistent postocular dark stripe in Cuban specimens is suppressed and absent in these Isla de Pinos adults. Finally, the juvenile individual (snout-vent length 62 mm) had the "pale" tail crossbands pale orange in life, a color not recorded in Cuban specimens. The juvenile specimen is, however, patterned like Cuban *T. a. americana*, or, perhaps more properly, the Isla de Pinos juvenile falls within the variation shown by Cuban lizards.

Scale counts on the six Isla de Pinos *T. americana* are: enlarged dorsal rows 17-29 (mean 19.0, mode 20), ventrals 35-37 (35.5), interorbitals 13-16 (15.0), gulars 19-31 (26.2), first toe lamellae 14-16 (14.5), fourth toe lamellae 14-16 (14.8); scales between sublabials modally 2 (4 specimens), but two specimens have 1 scale. Although the means of all counts are higher for the Isla de Pinos specimens, and the modal condition of scales between the postlabials is 2 (rather than 1 as in Cuba), the small series from the Isla de Pinos precludes any statistical analysis of these data. I think it highly likely that additional material

from the Isla de Pinos will show that the populations there differ rather markedly in size, pattern, and scutellological detail from their Cuban relatives.

Several authors (Schwartz and Ogren, 1956; Hardy, 1957; Buide, 1966) have pointed out that in Cuba *T. americana* is regularly associated with caves (where the animals rest in the twilight zone near the entrances during the day) and cliffs (where the animals forage, in addition to the cave mouths, at night). Ruibal (1957) reported the occurrence of *T. americana* inside the old erect dead trunks of mangroves (*Laguncularia*) on the Laberinto de las Doce Leguas off the Camagüey coast. These two habitats—cliffs and caves, and dead tree trunks—are the customary places where *T. a. americana* has been found. Other sites where lizards have been collected include inside a newly constructed storage shed and in a hollow royal palm (*Roystonea*). Both Alayo (1951: 107) and Buide (1967: 25) cited the capture of *T. americana* in the roofs of native *bohios*. All these latter situations are generally vertical faces as are the previously reported situations. Barbour (1914: 259) reported taking a specimen at Cabo Cruz under a stone, and Barbour and Ramsden (1919: 117) noted that numbers of specimens had been secured at Puerto Escondido in and under dead dry cactus. On occasion I have encountered *T. a. americana* on the ground, where it is often associated with rough limestone rocks which are imbedded in rocky soils. Near Guane in Pinar del Río, a lizard was collected in such a situation, although there were nearby a cave and low rocky cliffs. Perhaps the most unusual situation wherein I have taken *T. a. americana* is that of the specimen from west of Cayuco on the Península de Guanahacabibes; this individual was taken on a live but hollow tree in dense hardwood forest. There were no caves or cliffs in the immediate area, but the ground surface at this locality was rocky. Apparently *T. a. americana* exists in some regions where caves and their associated cliffs are absent, provided there is cover for diurnal retreats in the form of either large and chunky limestone rocks on the ground or hollow trees.

T. a. americana deposits its eggs in small hollows in the roofs and lower walls of caves or in small but fairly extensive rocky cavities (large enough to admit a person) in cliff faces. The eggs, of which two is the clutch, are white, hard-shelled, and adherent to the tops or sides of the cavities wherein they are deposited; most often there are large numbers of eggs deposited in the same immediate area, and the cave or cavity floor beneath the eggs is littered with many broken egg shells, which fall to the ground after the young have hatched. In this character, *T. a. americana* resembles *Anolis lucius* (see Allen and Neill, 1957, and Hardy, 1957, whose observations I can readily confirm) and *Anolis bartschi*, both of which have communal egg deposition areas and both of which occur syntopically with *Tarentola* on the same cliffs and cave entrances. However, *A. lucius* and *A. bartschi* are allopatric, so that *Tarentola* occurs only with one species or the other at any single locality.

A hatchling *T. a. americana* (MCZ 68937) has a snout-vent length of 24 mm.

No specimens of *T. a. americana* indicate its occurrence in the Cuban or Isla de Pinos uplands; most records are coastal, but this may only indicate the greater accessibility of coastal habitats, greater facility for collecting this species there, or more common occurrence of suitable habitats (caves and cliffs) at lower elevations or along the coast. The species occurs at San Vicente in the Sierra de los Organos at an elevation of about 1,000 feet (305 meters); Barbour and Ramsden (1919: 117) reported its occurrence at San Diego de los Baños in the adjacent Sierra del Rosario and at Los Negros in the northern foothills of the Sierra Maestra in Oriente. Koopman and Ruibal (1955: 6) reported a single fossil *Tarentola* dentary from pre- or post-Columbian cave deposits in the Sierra de Cubitas in Camagüey Province. Apparently the species occurs at least at intermediate elevations in some (and perhaps all) of the mountain massifs in Cuba.

Specimens examined: Cuba, Pinar del Río Province, 18 km W Cayuco, 1 (AMNH 81204); 3.5 km NE Guane, 1 (AMNH 81207); cliffs near San Vicente, 2 (AMNH 76545-46); 0.5 mi. (0.8 km) S San Vicente, 1 (AMNH 78204); 4 km S Rancho Mundito, 2 (AMNH 81205-06); Las Villas Province, Soledad, 1 (MCZ 43801); Guajimico, 16 mi. (25.6 km) SE Soledad, 2 (AMNH 78205-06); Trinidad, 7 (AMNH 78207-13); Finca Morales, 8 mi. (12.8 km) NW Trinidad, 8 (AMNH 78214-21); 8 mi. (12.8 km) NW Trinidad, 1 (AMNH 95980); 6 km W Trinidad, 1 (MCZ 59320); 12-13 km from Topes de Collantes, 1 (MCZ 59319); Cueva de Caguanes, Punta Caguanes, 1 (AMNH 81208); Camagüey Province, Cayo Cabeza del Este, 7 (MCZ 56358, 56365-70); Cayo Levisa, 8 (MCZ 57297, 56373-74, 56376-77, 56380, 56382, 56384); Oriente Province, Cabo Cruz, 1 (MCZ 8506); Santiago de Cuba, 2 (MCZ 6919, 19770); Morro Castle, Santiago de Cuba, 3 (UMMZ 90721); Playa Juraguá, 3.7 mi. (5.9 km) E Siboney, 6 (AMNH 83823—3 specimens, 95981—3 specimens); United States Naval Base, Guantánamo Bay, 5 (MCZ 93702, 68936-37, 67917, UMMZ 115733); Puerto Escondido, 1 (MCZ 9435); between Janeo and Imías, 2 (AMNH 17727-28); Caleta, costa sur, Baracoa, 1 (AMNH 17720); Cabo Maisí, 1 (AMNH 12855); Cabo Maisí, San Lucas (not mapped), 2 (AMNH 17725-26); Cabo Maisí, La Patana (not mapped), 10 (MCZ 11871, 11873-75, 11877-79, 96530, UF/FSM 21936, UMMZ 50073); Yaitresito, Baracoa (not mapped), 2 (MCZ 47047, 96331); Isla de Pinos (Habana Province), just W Nueva Gerona, east base, Sierra de las Casas, 2 (AMNH 81198, 81203); 1 mi. (1.6 km) SSW Nueva Gerona, east base, Sierra de las Casas, 3 (AMNH 81199-201); Bibijagua, 1 (AMNH 81202).

Tarentola americana warreni new subspecies

Holotype: United States National Museum (USNM) 160725, an adult male, from Gray's Settlement, Long Island, Bahama Islands, one

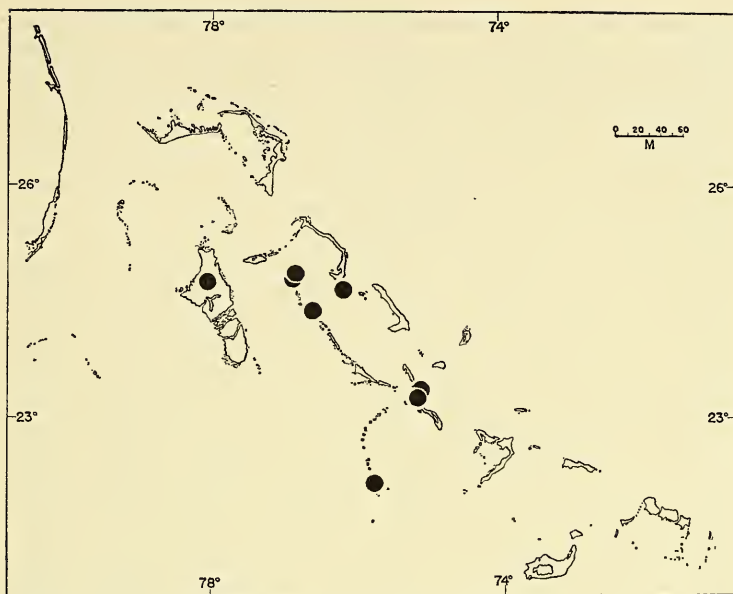


FIG. 2. Map of the Bahama Islands, showing (solid circles) localities whence specimens of *T. a. warreni* have been examined.

of a series collected between 27 and 29 May 1967 by C. Rhea Warren. Original number V11233.

Paratypes: ASFS V11232, V11234, same data as holotype; ASFS V8587-91, CM 45821, USNM 160724, same locality as holotype, 23-30 January 1965, C. R. Warren; ASFS V10839, east of Salt Pond, Long Island, Bahama Islands, 13 October 1966, R. Thomas.

Associated specimens: Bahama Islands, Eleuthera, lighthouse, South-east Point, 1 (MCZ 96078); Andros, 1 (MCZ 19566); Exuma Cays, U Cay, Allan's Harbour Cays, 1 (MCZ 12330); Leaf Cay (= S. W. Allan's Cay), Allan's Harbour Cays, 18 (ASFS V10704-05, AMNH 80131-37, CM 41135-36, UMMZ 117391-7 specimens); Warderick Wells Cay, 10 (UF/FSM 23096-105); Ragged Islands, Great Ragged Island, Duncantown, 2 (UMMZ 118024-25).

Distribution: Islands of the Great Bahama Bank, Bahama Islands; known from the islands of Eleuthera, Andros, Exuma Cays (U Cay or S. W. Allan's Cay, Leaf Cay, Warderick Wells Cay), Long, and Great Ragged. The species has not heretofore been reported in the Bahamas from Long Island or the Ragged Islands. See Fig. 2.

Definition: A subspecies of *T. americana* characterized by small size (males to 92 mm, females to 88 mm snout-vent length), low number of transverse ventral scales (usually 23 to 29), low number of interorbital

scales, low number of gular scales, scales bordering mental posteriorly variable by population but modally 3 on Long Island (see detailed discussion); area between enlarged lateral scales and ventrals (ventrolaterally) lacking transitional scales, the enlarged laterals abutting directly on the ventrals at the ventrolateral fold; dorsal colors most often combinations of gray and black (although tans and browns occur in some samples), and pale bands on unregenerated tails with black dots, occasionally fused into short black dashes or longitudinal streaks, very bold and clear against the white band color.

Description of holotype: An adult male, left hemipenis extruded, snout-vent length 81 mm, tail about 92 mm, complete and unregenerated; enlarged dorsal scale rows 21, ventral scales 28, interorbital scales 13, gular scales 20, first toe lamellae 12, fourth toe lamellae 13, 3 scales between sublabials and bordering the mental. Dorsum in life very pale gray, almost white, with very scattered black dots on the dorsal scales; head concolor with back, but with a broad white preocular band across the snout (including the lores anterior to the eyes); postocular stripe absent, but a white postocular line present from the posterior upper margin of the eye across the temples; dorsal crossbanding barely evident, the grayish band remnants separated by narrowed bands of very pale gray to white; limbs gray, vaguely marbled with darker and with some still darker gray dots on the hindlimbs; tail with eight "dark" bands, the more proximal ones pale gray, grading to darker gray distally; pale tail bands white, with scattered jet black dots enclosed therein, the black dots occurring also on the "dark" bands as well; venter in life pale ochraceous.

Variation: Combined data for all (44) specimens of *T. a. warreni* are: maximum snout-vent length in males 92 mm (ASFS V8588, Long Island) in females 88 mm (UF/FSM 23103, Warderick Wells Cay); enlarged dorsal rows 16–24 (mean 19.6, mode 19), ventrals 23–31 (26.8), interorbitals 11–16 (13.4), gulars 14–23 (18.6), first toe lamellae 12–16 (13.1), fourth toe lamellae 11–17 (13.4).

The scales between the sublabials and bordering the mental show the following pattern. On Long Island, the mode is 3 (eight of 11 specimens; range 0–3). On Warderick Wells Cay, the mode is 1 (seven of 10 specimens; range 0–2). On the Allan's Harbour Cays, there is a weak mode of 2 (eight specimens) with 0 having an almost equal incidence (seven specimens; range 0–3). The single Andros specimen has 2 scales in this position, the Eleuthera specimen 1, and the two Great Ragged specimens have counts of 1 and 2. Combining data for all Bahaman specimens, nine specimens have counts of 0, 12 have counts of 1, 13 have counts of 2, and 10 have counts of 3. It is obvious that there is a great degree of modal variation in this count, depending on the island involved. Of great interest is the fact that, within the Exuma Cays, the Allan's Harbour Cays are almost bimodal (0 and 2), whereas Warderick Wells Cay some 50 miles (80 km) to the southeast has a strong modality of 1. Admittedly in all cases the samples are rather small, but the

evidence for interisland variation seems conclusive. It is of course conceivable that, when much additional material is collected, it will be possible to show that there is more than one subspecies of *T. americana* on the Bahama Islands; the material presently available does not suggest this.

The basic colors of *T. a. warreni* are grays and blacks, although some specimens, even from Long Island, were recorded as having tans and browns in life. Except in small lizards (ASFS V10705, for instance), the dorsum does not show the dark crossbands which customarily are demonstrated by *T. a. americana*. If these crossbands are present, they are usually faint (ASFS V8590) and the interband pale bars are fairly broad but not too well defined. The dark postocular stripe is brown to black and is often fragmented and occasionally absent, as in the holotype; if the latter is the case, the white line dorsal to the postocular stripe remains as a fairly conspicuous cephalic feature. The most common dorsal condition is the presence of more or less scattered black speckling, often arranged into rather vague short lines or dashes, over the entire dorsum; these scattered dorsal markings tend additionally to obscure the dark dorsal crossbands. The head figure described for *T. a. americana* is almost always absent in *warreni*; some specimens (ASFS V8588) show remnants of it. If the head figure is present, it is always very broken and barely definable. The ventral color varies from pale ochraceous to yellow or pinkish and is not tan as in *T. a. americana*. The dark dotting on unregenerated tails of *warreni* is a conspicuous feature of all adults. The general aspect is of a gray-and-white-banded tail with scattered black dots, occasionally fused into short longitudinal but equally dark dashes. Although these dots and/or dashes are about equally distributed over the entire upper surface of the tail, they stand out more boldly against the white rather than the gray bands. The black dotting is most prominent after about the third basal dark band, so that specimens lacking the major portion of the tail barely show this feature and do not show it at all on the regenerated portion of the tail, which is uniformly striate longitudinally above and below.

Comparisons: The simplest method for differentiating *americana* from *warreni* is the examination of the lower sides above the ventrolateral folds. In *warreni*, the enlarged laterals abut directly against the smaller and smooth ventrals, whereas in *americana*, these two scale types are separated by several rows of transitional scales. Some *warreni* may have a few intermediate scales scattered throughout this transitional area, but none has the four to eight rows which occur in *americana*. The two subspecies differ in number of transverse ventrals: only two of 44 *warreni* have counts above 30, whereas only six of 80 *americana* have counts below 30. Mean numbers of ventrals are statistically different (*americana*— 33.5 ± 1.01 ; *warreni*— $26.8 \pm .60$). Mere gross examination of specimens of *americana* and *warreni* of comparable snout-vent lengths will easily demonstrate this difference in almost all individuals; the much larger ventrals of *warreni* are obvious. Likewise, the smaller

number of gulars (mean 18.6) and the fewer interorbitals in *warreni* (mean 13.4) differ significantly from comparable means in *americana* (gulars 24.6, interorbitals 14.3). In general, *warreni* has larger scales and thus has lower counts than *americana*.

The pattern and color differences are more subtle. The generally gray to black colors of *warreni* differ from the tans to browns of *americana*, although some *warreni* were recorded as being brown and tan. In general, the dorsa of *warreni* are not heavily crossbarred as are those of *americana* but are rather much paler and unicolor, with suppression of the dark postocular line; some *americana*, however, lack obvious dorsal pattern, notably those from the Isla de Pinos. The dorsum of *warreni* is often longitudinally streaked or striate, whereas that of *americana* is seldom so. The most easily determined color and pattern differences are the black and white (*warreni*) versus brown and tan to buff (*americana*) unregenerated tails; the presence of discrete black dots or dashes on the tails of *warreni* distinguish it from the only vaguely streaked tails of *americana*. Except for the last chromatic character, the two subspecies overlap as far as pattern is concerned. This is all the more remarkable since so many Antillean reptile subspecies are defined primarily on color and secondarily on scutellogical details. The reverse is true in *T. americana*, where the scales offer far better means of differentiation than do color and pattern. Nevertheless, although difficult to quantify, there are color and pattern differences between the two subspecies.

Remarks: The series of *T. a. warreni* from the type locality was collected there by Warren in two visits. The earlier series was taken in abandoned stone houses, the lizards resting during the day in crannies and crevices between the stones; at night the lizards were actively foraging on the house walls and rafters. On the second visit to these houses, over two years later, Warren found them stacked to the ceiling with cut wood, so that he was unable to secure lizards inside the houses themselves. The specimen from east of Salt Pond on Long Island was taken by Thomas in *Cocos* trash on the ground at the base of a coconut tree. The two ASFS Leaf Cay lizards were secured around the edges of limestone slabs in palm woods. Rabb and Hayden (1957: 23) collected their series on Leaf Cay under large limestone slabs. Since Leaf Cay is exceptionally well strewn with rocks and slabs, *T. a. warreni* is doubtless abundant there.

The scattered nature of *Tarentola* records in the Bahamas surely does not reveal the complete range of the species in that archipelago. Considering that the first Bahaman *Tarentola* was collected by G. Sabille in 1900 and that no further material was collected in quantity until the Rabb and Hayden specimens (1953), it is obvious that Bahaman *Tarentola* are not easily secured except under the most favorable circumstances. The facts that no recent collector has taken the species on Andros and that only very recently was the Eleuthera specimen secured, suggest that in some areas the species is uncommon. Certainly the Bahamas are becoming better known herpetologically, but many details

of distribution remain to be clarified. An interesting sidelight is that Richard Thomas, aware that *T. americana* had been collected on three of the Exuma Cays, made special effort to secure specimens on Great and Little Exuma where he searched cave entrances and cliffs for these animals—typical Cuban situations. He found no *Tarentola* on these two islands in these situations; in fact, insofar as I know, no Bahaman *Tarentola* have been taken in cave mouths or on adjacent cliffs, niches which *Tarentola* frequents in Cuba. Possibly there are ethological or ecological differences between the subspecies *americana* and *warreni*. I know of no eggs of *T. a. warreni* having been collected and none of the series is a hatchling; the smallest specimen has a snout-vent length of 31 mm (UMMZ 118025).

Discussion

Tarentola americana has been shown to be composed of two populations, whose divergence has been primarily in scutellological details rather than color and pattern as is often the case with Antillean reptile subspecies. There is a possibility that the Isla de Pinos *Tarentola* will ultimately be shown to differ from their Cuban relatives, but present collections are inadequate for assessment of the apparent chromatic and pattern differences between these populations. Additionally, it is also possible that more Bahaman specimens will demonstrate differences between *Tarentola* throughout the Great Bank islands, although this seems less probable to me than nomenclatural recognition of the Isla de Pinos lizards.

Since *T. americana* is the only New World representative of an otherwise Old World genus, it seems likely that the West Indies species has long been in residence on Cuba. The apparent lack of differentiation into recognizable subspecies on Cuba suggests also that *T. americana* is extremely stable genetically. On the other hand, as far as the Bahamas are concerned, *T. americana* is presumably one of the relatively recent immigrants (from Cuba) into that archipelago; I (MS) have suggested that the present Bahaman herpetofauna is composed of two elements, one an old and relict fauna, occurring on islands south of the Crooked Island Passage and some other islands on their own banks, and a relatively new and recent fauna, derived principally from Cuba, whose members are not, or only subspecifically, different from their Cuban relatives. This newer herpetofauna arrived in the Bahamas during the Pleistocene or post-Pleistocene, since it is generally agreed that the Great Bank was completely submerged during the Pliocene and may have been submerged, at least partially, during the Pleistocene. If so, then the strong scale differences between *americana* and *warreni* have had to evolve relatively recently and relatively quickly. Those Bahaman *Tarentola* which are geographically closest to Cuba (specimens from Great Ragged Island, removed about 75 miles—120 km—from the north shore of Cuba) show no approach to *T. a. americana* in scalation nor

pattern. Such differences are all the more striking when the uniformity of *T. a. americana* is considered. Perhaps *Tarentola* is an old Bahaman relict, which persisted on one of the outer Great Bank islands (such as Eleuthera, where it still occurs today) which are part of the Bahaman volcanic arc. Such a longer period (Pliocene ?) of separation from its Cuban congeners might account for the differences in scutellation which segregate *T. a. warreni* from the nominate subspecies.

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